

***NYSIUS AA* (HETEROPTERA: LYGAEIDAE), A NEW SPECIES OF
MICROPTEROUS WEKIU BUG FROM THE SUMMIT OF
MAUNA LOA VOLCANO, HAWAII**

DAN A. POLHEMUS

Department of Entomology, MRC 105, National Museum of Natural History, Smithsonian Institution, Washington, DC 20560, U.S.A. (e-mail: polhemus.dan@nmnh.si.edu)

Abstract.—*Nysius aa*, a micropterous lygaeid bug, is described from the upper slopes of Mauna Loa volcano on the island of Hawaii. This new species appears to be the sister species of *Nysius wekiuicola* Ashlock and Gagné, which is endemic to aeolian desert habitats in the summit region of adjacent Mauna Kea volcano. Detailed morphological comparisons between the two species are presented, accompanied by a distribution map and figures of key characters.

Key words: Lygaeidae, micropterous, alpine, aeolian, Hawaii, Mauna Kea, Mauna Loa

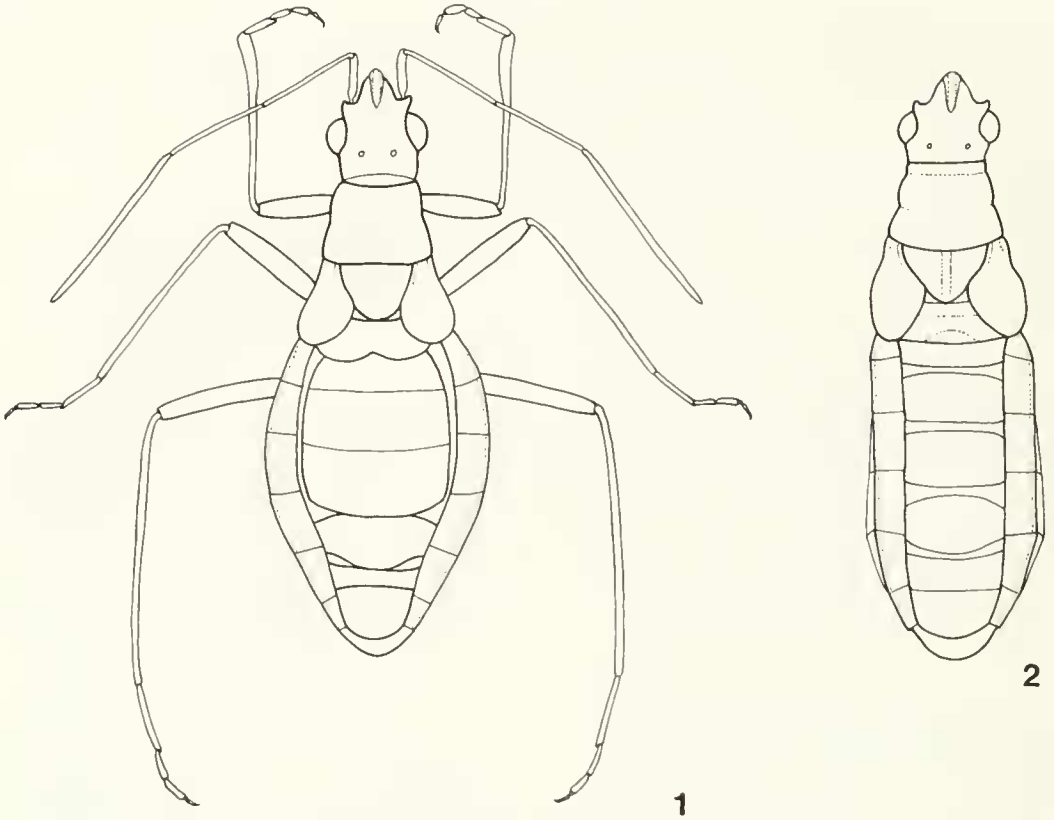
The Wekiu Bug, *Nysius wekiuicola*, a micropterous lygaeid endemic to the aeolian deserts surrounding the 4206 m (13,796 ft.) summit of Mauna Kea volcano on the island of Hawaii, was described by Ashlock and Gagné (1983). In the same paper, these authors commented on anecdotal accounts of similar bugs occurring on the 4170 m (13,680 ft.) summit of Mauna Loa volcano to the southwest. In 1985, Frank Howarth of the Bishop Museum and Fred Stone of the Hawaii Community College at Hilo emplaced pitfall traps at 3450 m (11,316 ft.) elevation on Mauna Loa, and were able to capture a short series of micropterous lygaeids. In general appearance these Mauna Loa bugs were similar to the Wekiu Bugs from Mauna Kea, and the material was not analyzed further at that time. In the mid-1990's, with the continuing expansion of observatory facilities on the summit of Mauna Kea, concerns were raised regarding the progressive destruction of Wekiu Bug habitat on that mountain due to construction activities. The possible presence of additional Wekiu Bug populations on Mauna

Loa thus became a question of some importance in terms of conservation planning, and the existence of the Howarth and Stone material from the latter mountain was brought to the author's attention by Betsy Gagné, of the State of Hawaii's Natural Area Reserves System, a unit of which includes portions of the Mauna Kea summit. The Mauna Loa specimens were subsequently located in the collections of the Bishop Museum and analyzed in detail; they have proven to represent a distinct new species, described below.

All measurements in the following description are in millimeters.

***Nysius aa* Polhemus, new species**
(Figs. 1, 3, 4, 7, 9)

Diagnosis.—A small, fuzzy, dark-colored micropterous lygaeid bug, similar in general appearance to *N. wekiuicola* Ashlock and Gagné, but easily separable on the basis of the following characters: body in males pear-shaped, with sides of abdomen distinctly outwardly convex (versus nearly parallel sided in *N. wekiuicola*; compare



Figs. 1–2. Wekiu Bugs, males, dorsal habitus. 1, *Nysius aa*. 2, *N. wekiuicola*, showing overall body shape for comparison to Fig. 1 (appendages omitted). As noted by Ashlock and Gagné (1983), the abdomens of Wekiu Bugs are strongly physogastric, swelling after feeding, and collapsing drastically in all dry mounted specimens except those which have been run through a critical point drier. As a result, these insects are difficult to illustrate, with the best results coming from specimens in alcohol immersion. Fig. 1 of Ashlock and Gagné (1983) depicts a specimen of *N. wekiuicola* with the abdomen swollen, while this figure depicts the abdomen in a more relaxed state that better displays the actual shapes of the lateral paratergites for comparison with *N. aa*.

Figs. 1 and 2); female abdominal ventrite IV with only a weak medial incision at base of ovipositor (versus incised for nearly half its length in *N. wekiuicola*; compare Figs. 3 and 4); female abdominal tergite VIII consisting of two roughly quadrate plates with the lateral margins straight (versus plates of a different shape with the lateral margins angulate in *N. wekiuicola*; compare Figs. 5 and 6); and male paramere with a narrow pointed tip (versus a broader, more rounded tip in *N. wekiuicola*; compare Figs. 7 and 8).

Description.—*Micropterous male*: Overall length 3.75; maximum width (across abdomen) 1.50. General coloration dark to

medium brown, head and pronotum blackish, appendages yellowish brown distally.

Head: Length 0.75, width 0.75, general coloration black, with a yellowish brown longitudinal median line, this line most prominent on posterior half of head, often becoming obscure ahead of eyes, small dark yellowish marks also present along inner margins of eyes; dorsal surface slightly elevated between eyes, lightly rugose, thickly clothed with recumbent to semi-recumbent pale pubescence; apex of clypeus with erect pale hairs; anteocular length 0.37, nearly $1.7\times$ length of an eye; eyes reddish brown, eye length 0.22, width 0.15; interocular space 0.42; ocelli small, dark yellow; buc-

cula low, gradually tapering in height without abrupt change in width to base of head; rostrum brown, reaching to hind coxae, segment I nearly reaching to base of head, segment lengths (from base) 0.57, 0.55, 0.40, 0.30; antennae long, slender, segments I and IV only slightly thicker than segments II and III, segments I–III brown, bearing erect pale setae, these setae slightly longer than diameters of these segments, segment IV yellowish brown, bearing erect pale setae intermixed with a dense covering of short, semi-recumbent pale setae, lengths of segments I–IV = 0.44, 0.80, 0.56, 1.37.

Pronotum: Length (midline) 0.50, maximum width 0.75, dark brown to blackish, narrowly dark yellow along extreme anterior margin; dorsal surface thickly clothed with recumbent to semi-recumbent pale pubescence; disc deeply and coarsely rugose; lateral pronotal margins weakly constricted near middle, barely defining anterior and posterior lobes.

Scutellum: Length (midline) 0.25, maximum width 0.50, dark brown to blackish, bearing a raised, brown, longitudinal medial carina; surface thickly clothed with recumbent to semi-recumbent pale pubescence.

Hemelytra: Micropterous, brown, lighter near tips, length 0.50, reaching only to abdominal tergite I, not touching along body midline; clavus weakly distinct from corium basally, venation obscure except for extreme basal portion of subcosta; surface dull and impunctate, bearing recumbent to semi-recumbent pale pubescence.

Abdomen: Lateral margins outwardly convex, length 2.27, maximum width 1.73; tergites brown, with I, VI and VII darker, all tergites bearing scattered fine, pale, semi-recumbent, setae, and separated by membranous areas; lengths of tergites I–VII (midline) = 0.25, 0.20, 0.42, 0.45, 0.27, 0.12, 0.31; paratergites dark brown, bearing recumbent to semi-recumbent pale pubescence; ventral surface dark brown, shining, bearing scattered long, fine, pale, semi-recumbent setae.

Legs: Long and slender, femora brown;

coxae, trochanters, tibiae and tarsi yellowish brown; all segments clothed with fine, pale, semi-recumbent setae intermixed with scattered longer erect pale setae; fore tibia slightly expanded on distal $\frac{1}{5}$. Lengths of leg segments as follows: fore femur, tibia, tarsal I, tarsal II, tarsal III = 1.07, 1.27, 0.37, 0.16, 0.25; middle femur, tibia, tarsal I, tarsal II, tarsal III = 1.25, 1.35, 0.37, 0.17, 0.25; hind femur, tibia, tarsal I, tarsal II, tarsal III = 1.50, 1.80, 0.52, 0.21, 0.25.

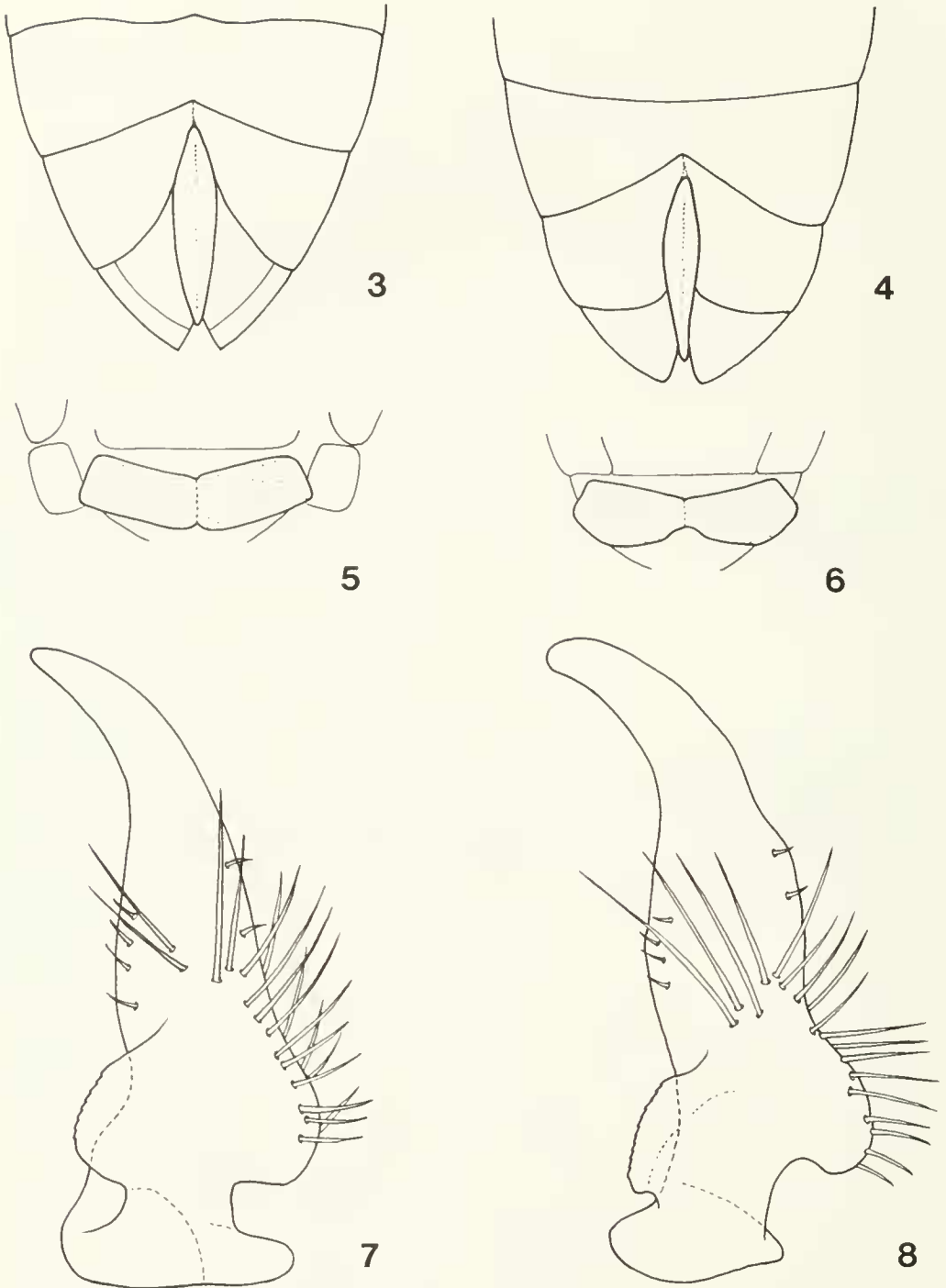
Male paramere coming to an elongate, pointed tip, shape as in Fig. 7.

Micropterous female: Length 4.30; maximum width 1.90. Similar to male in general structure and coloration with following exceptions: abdominal tergite VIII narrow and transverse, consisting of a pair of quadrate plates (Fig. 5); abdominal ventrite IV weakly indented medially on its posterior margin ahead of base of ovipositor, this indentation less than half length of segment as taken along its lateral margin (Fig. 3); abdominal ventrite V deeply cleft for nearly its entire length to accommodate ovipositor sheath (Fig. 3).

Etymology.—The name “*aa*” is a noun in apposition and refers to the flows of a lava where this species dwells.

Material examined.—Holotype, micropterous ♂: HAWAIIAN ISLANDS, Hawaii Is., N. side of Mauna Loa, above MLO [Mauna Loa Observatory], 3450 m (11,316 ft.), 30 March–13 April 1985, from baited pitfall trap #3, F. G. Howarth, D. G. Howarth, V. M. C. Howarth and F. D. Stone, deposited in the Bishop Museum, Honolulu (BPBM). Paratypes (all micropterous): 4 ♂, 3 ♀, same data as holotype, deposited in the Bishop Museum and the National Museum of Natural History, Smithsonian Institution, Washington, D.C.

Discussion.—The flightless lygaeids inhabiting the highest summits of Hawaii island have come to be commonly referred to as “Wekiu Bugs” by Hawaiian entomologists, “*wekiu*” meaning “summit” in the Hawaiian language. Within the large and speciose genus *Nysius* the Wek-



Figs. 3-8. Female abdominal structures (3-6) and male parameres (7-8) of Hawaiian alpine *Nysius* species. 3, *Nysius aa*, terminal abdomen, ventral view (note degree of medial incision on ventrite IV at base of ovipositor). 4, *N. wekiuicola*, terminal abdomen, ventral view. 5, *N. aa*, abdominal tergite VIII. 6, *N. wekiuicola*, abdominal tergite VIII. 7, *N. aa*. 8, *N. wekiuicola*.

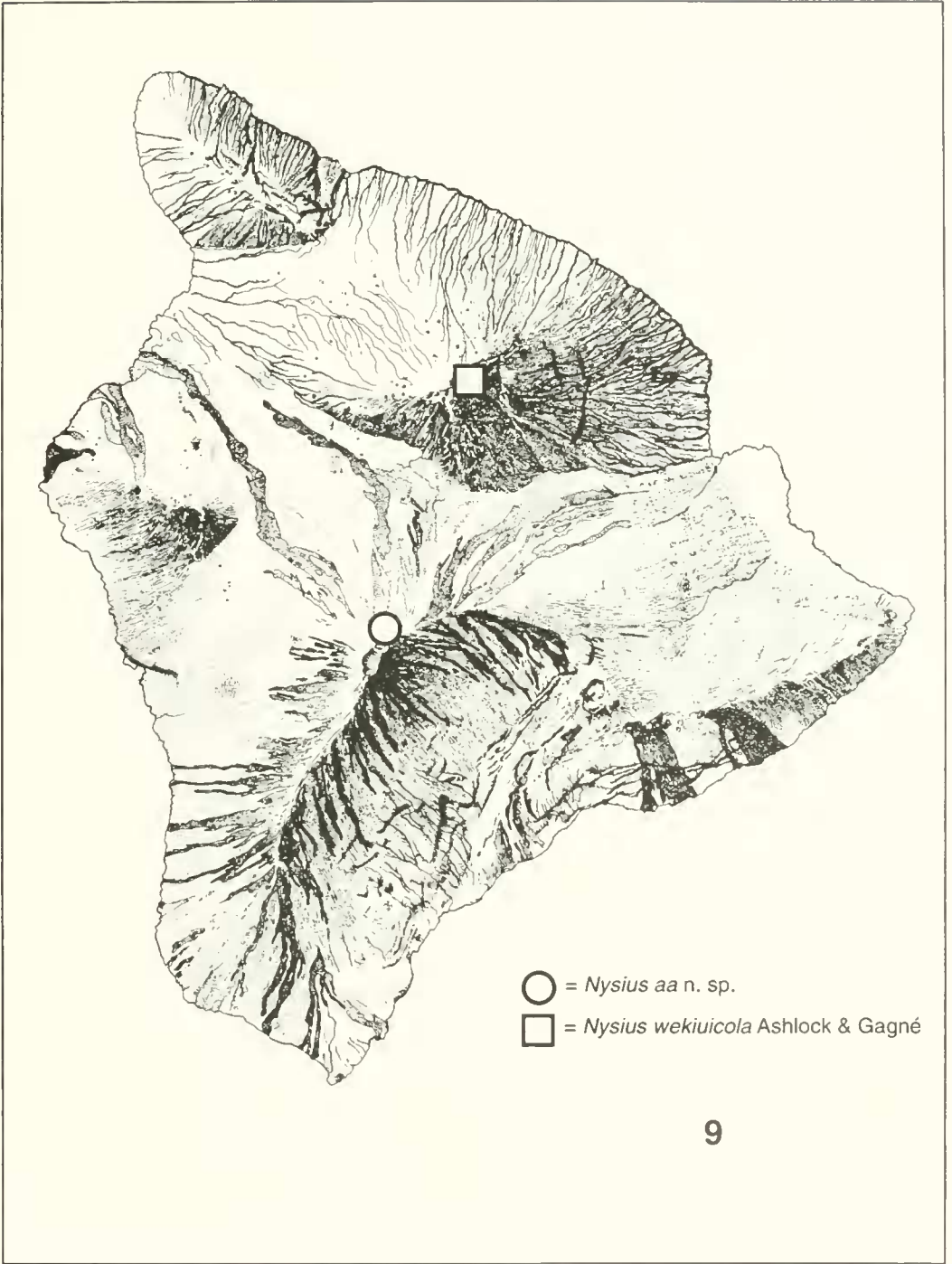


Fig. 9. Distribution of alpine *Nysius* species on Hawaii Island. Circle = *N. aa*; square = *N. wekiuicola*.

iu Bugs are an interesting insular segregate, characterized by restriction to high elevations (Fig. 9), micropterous wings, and a scavenging lifestyle. *Nysius aa* presumably feeds on dead insects that melt out of the margins of retreating snow fields on the upper slopes of Mauna Loa during the summer season, a habit documented for its close relative *N. wekiuicola* on Mauna Kea (Howarth and Montgomery 1980). A seed feeding existence for *N. aa* seems unlikely, since the aeolian deserts at the elevations it inhabits consist of utterly barren lava flows devoid of seed bearing plants that elsewhere constitute the typical food source for the overwhelming majority of the world's Lygaeidae (Ashlock and Gagné 1983).

During the Pleistocene the summit of Mauna Kea was glaciated (Porter 1979 a, b, c), and given the consequent depression of life zones on the mountains during this period, it is likely that the two currently allopatric populations of Wekiu Bugs were intermingled via a continuous belt of aeolian desert extending across the Humuula Saddle. The separation of *N. aa* and *N. wekiuicola* on different mountains is thus an event that is probably no more than 20,000 years old, and begs the interesting question as to whether speciation has proceeded from a common ancestor within this short time frame.

Ashlock and Gagné, in their 1983 paper, predicted that the closest relative of their *N. wekiuicola* would be discovered in the Hawaiian islands, and with the discovery and description of *N. aa* this prediction has indeed been borne out. A more interesting subject for future research, however, is to locate the closest relatives of the Wekiu Bugs *per se*. It seems likely that the colonization of the high mountain summits on Hawaii was accomplished from the bottom up, and that putative Wekiu Bug sister groups might be found in similar aeolian-supplied ecosystems in a'a lava flows at lower elevations. Already, in a scenario strangely reminiscent

of what transpired on Mauna Loa several decades ago, a few specimens of an unusual and apparently undescribed *Nysius* have come to light from baited pitfall traps set in a'a flows near 600 meters elevation in the Manuka Natural Area Reserve, on the southwest rift zone of Mauna Loa. Although insufficient to allow a species description, the single female and immature so far obtained indicate that the nearest relatives of the Wekiu Bugs may well be close at hand.

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This project has built upon years of effort by many dedicated researchers who worked in harsh and difficult conditions to obtain specimens and ecological data. Prime among these are Frank Howarth, Bill and Mae Mull, Fred Stone, and Steve Montgomery, who were the first to bring the remarkable alpine insect communities of Mauna Kea to the attention of the scientific world. No less important are the contributions of the late Wayne Gagné and his wife Betsy; the former an indefatigable and creative collector who greatly advanced our knowledge of Hawaiian Heteroptera, and the latter a tireless champion for the conservation of native Hawaiian ecosystems and their irreplaceable biota. This paper is very much a distillation of their years of work, and I thank them all very much for openly sharing the results of their labors.

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